

## EXHIBIT C

eMedicine - <http://www.emedicine.com/orthoped/topic455.htm>

**Etiology:** The etiology of CTS is multifactorial, with both local and systemic factors contributing to varying degrees. Symptoms of CTS are a result of median nerve compression at the wrist, with ischemia and impaired axonal transport of the median nerve across the wrist. Compression results from elevated pressures within the carpal canal. Elevated pressures can develop within the carpal canal despite it not being a separate closed compartment within the upper extremity. Direct pressure or a space-occupying lesion within the carpal canal can increase pressure on the median nerve and produce CTS. Fracture callus, osteophytes, anomalous muscle bodies, tumors, hypertrophic synovium, gout and other inflammatory conditions, and infection can produce increased pressure within the carpal canal. Extremes of wrist flexion and extension also elevate pressure within the carpal canal.

Compression of a nerve affects intraneural blood flow. Pressures as low as 20-30 mm Hg retard venular blood flow in a nerve. Axonal transport is impaired at 30 mm Hg. Neurophysiologic changes manifested as sensory and motor dysfunction are present at 40 mm Hg. Further increases in pressure produce increasing sensory and motor block. At 60-80 mm Hg, complete cessation of intraneural blood flow is observed. The carpal canal pressures in patients with CTS averaged 32 mm Hg compared to only 2 mm Hg in control subjects.

Pressure on the median nerve at a second site remote from the wrist, termed the double crush syndrome, can further lower the median nerve's pressure threshold for producing symptoms of CTS. If a nerve is compressed at multiple sites, traction within the nerve with joint motion may be produced. In addition to pressure, traction or stretch has been demonstrated to produce alterations in intraneural circulation. Elongation of only 8% can impair venular flow, and all intraneural microcirculation can cease at 15% nerve elongation.

Many systemic conditions are strongly associated with CTS. These conditions may directly or indirectly affect microcirculation, pressure thresholds for nerve conduction, nerve cell body synthesis, and axon transport or interstitial fluid pressures. Perturbations in the endocrine system, as observed in individuals with diabetes and hypothyroidism and in women who are pregnant, are linked to CTS. Conditions affecting metabolism (eg, alcoholism, renal failure with hemodialysis, mucopolysaccharidoses) also are associated with CTS.

The international debate regarding the relationship between CTS and repetitive motion and work is ongoing. The Occupational Safety and Health Administration (OSHA) has adopted rules and regulations regarding cumulative trauma disorders. Occupational risk factors of repetitive tasks, force, posture, and vibration have been cited. However, the American Society for Surgery of the Hand has issued a statement that the current literature does not support a causal relationship between specific work activities and the development of diseases such as CTS.

Psychosocial and socioeconomic issues increasingly are being studied. In a study of risk factors for CTS in women, the strongest link was a previous history of another musculoskeletal

complaint. Perceptions of health and tolerance to pain also may influence the development of CTS.

**Pathophysiology:** The pathophysiology of CTS typically is demyelination. In more severe cases, secondary axonal loss may be present. The most consistent findings of biopsy specimens of tenosynovium in patients undergoing surgery for idiopathic CTS have been vascular sclerosis and edema. Localized amyloid deposition in the tenosynovium also has been reported in persons with idiopathic CTS. Inflammation, specifically tenosynovitis, is not part of the pathophysiologic process in chronic idiopathic CTS.